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TITLE: TELEMATICS UNIT HAVING INTERACTIVE RADIO FEATURES

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TELEMATICS UNIT HAVING INTERACTIVE RADIO FEATURES

FIELD OF THE INVENTION

This invention relates generally to wireless communications with a mobile vehicle. More specifically, the invention relates to a method and system for implementing interactive radio features within a telematics equipped vehicle.

BACKGROUND OF THE INVENTION

The opportunity to utilize wireless features in a mobile vehicle is ever increasing as the automobile is being transformed into a communications and entertainment platform as well as a transportation platform. Wireless features include wireless vehicle communication, networking, maintenance and diagnostic services for a mobile vehicle.

Typically, conventional wireless systems within mobile vehicles (e.g. telematics units) provide voice communication. Recently, these wireless systems have been utilized to update systems within telematics units, such as, for example radio station presets. Other systems within mobile vehicles, such as, for example a power train control may be updated as well. Information may also be collected from systems and subsystems within mobile vehicles and provided to a vehicle manufacturer for analysis, such as, for example system usage, component wear, and the like.

The present invention advances the state of the art.

SUMMARY OF THE INVENTION

One aspect of the invention includes a method for operating a telematics unit within a mobile vehicle including receiving radio station information, detecting an initiation command received from a user interface, and providing the radio station information to the telematics unit responsive to the detected initiation command.

In accordance with another aspect of the invention, a computer readable medium storing a computer program includes: computer readable code for sensing received radio station information; computer readable code for detecting an initiation command received from a user interface; and computer readable code for providing the radio station information to the telematics unit responsive to the detected initiation command.

In accordance with yet another aspect of the invention, a system for operating a telematics unit within a mobile vehicle is provided. The system includes means for receiving radio station information. Means for detecting an initiation command received from a user interface is provided. Means for providing the radio station information to the telematics unit responsive to the detected initiation command is also provided.

The aforementioned, and other features and advantages of the invention will become further apparent from the following detailed description of the presently preferred embodiments, read in conjunction with the accompanying drawings. The detailed description and drawings are merely illustrative of the invention rather than limiting, the scope of the invention being defined by the appended claims and equivalents thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates an operating environment for implementing wireless communication within a mobile vehicle communication system;

FIG. 2 is a block diagram of telematics based programming gateway in accordance with an embodiment of the present invention,

FIG. 3 is a block diagram of a system for implementing interactive radio features within a telematics equipped mobile vehicle; and

FIG. 4 is a flow diagram of one embodiment of a method of implementing interactive radio features within a telematics equipped mobile vehicle, in accordance with the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates one embodiment of system for data transmission over a wireless communication system, in accordance with the present invention at **100**. Mobile vehicle communication system (MVCS) **100** includes a mobile vehicle communication unit (MVCU) **110**, a vehicle communication network **112**, a telematics unit **120**, one or more wireless carrier systems **140**, one or more communication networks **142**, one or more land networks **144**, one or more client, personal or user computers **150**, one or more web-hosting portals **160**, and one or more call centers **170**. In one embodiment, MVCU **110** is implemented as a mobile vehicle equipped with suitable hardware and software for transmitting and receiving voice and data communications. MVCS **100** may include additional components not relevant to the present discussion. Mobile vehicle communication systems and telematics units are known in the art.

MVCU **110** may also be referred to as a mobile vehicle throughout the discussion below. In operation, MVCU **110** may be implemented as a motor vehicle, a marine vehicle, or as an aircraft. MVCU **110** may include additional components not relevant to the present discussion.

MVCU **110**, via a vehicle communication network **112**, sends signals to various units of equipment and systems (detailed below) within MVCU **110** to perform various functions such as unlocking a door, opening the trunk, setting personal comfort settings, and calling from telematics unit **120**. In facilitating interactions among the various communication and electronic modules, vehicle communication network **112** utilizes network interfaces such as controller-area network (CAN), International Organization for Standardization (ISO) Standard 9141, ISO Standard 11898 for high-speed applications, ISO Standard 11519 for lower speed applications, and Society of Automotive Engineers (SAE) Standard J1850 for high-speed and lower speed applications.

MVCU **110**, via telematics unit **120**, sends and receives radio transmissions from wireless carrier system **140**. Wireless carrier system **140** is implemented as any suitable system for transmitting a signal from MVCU **110** to communication network **142**.

Telematics unit **120** includes a digital signal processor (DSP) **122** connected to a wireless modem **124**, a global positioning system (GPS) unit **126**, an in-vehicle memory **128**, a microphone **130**, one or more speakers **132**, and an embedded or in-vehicle mobile phone **134**. In other embodiments, telematics unit **120** may be implemented without one or more of the above listed components, such as, for example GPS unit **126** or speakers **132**. Telematics unit **120** may include additional components not relevant to the present discussion.

In one embodiment, DSP **122** is implemented as a microcontroller, microprocessor, controller, host processor, or vehicle communications processor. In an example, DSP **122** is implemented as an application specific integrated circuit (ASIC). In another embodiment, DSP **122** is implemented as a processor working in conjunction with a central processing unit (CPU) performing the function of a general purpose processor. GPS unit **126** provides longitude and latitude coordinates of the vehicle responsive to a GPS broadcast signal received

from a one or more GPS satellite broadcast systems (not shown). In-vehicle mobile phone **134** is a cellular-type phone, such as, for example an analog, digital, dual-mode, dual-band, multi-mode or multi-band cellular phone.

DSP **122** executes various computer programs that control programming and operational modes of electronic and mechanical systems within MVCU **110**. DSP **122** controls communications (e.g. call signals) between telematics unit **120**, wireless carrier system **140**, and call center **170**. In one embodiment, a voice-recognition application is installed in DSP **122** that can translate human voice input through microphone **130** to digital signals. DSP **122** generates and accepts digital signals transmitted between telematics unit **120** and a vehicle communication network **112** that is connected to various electronic modules in the vehicle. In one embodiment, these digital signals activate the programming mode and operation modes, as well as provide for data transfers. In this embodiment, signals from DSP **122** are translated into voice messages and sent out through speaker **132**.

Communication network **142** includes services from one or more mobile telephone switching offices and wireless networks. Communication network **142** connects wireless carrier system **140** to land network **144**. Communication network **142** is implemented as any suitable system or collection of systems for connecting wireless carrier system **140** to MVCU **110** and land network **144**.

Land network **144** connects communication network **142** to client computer **150**, web-hosting portal **160**, and call center **170**. In one embodiment, land network **144** is a public-switched telephone network (PSTN). In another embodiment, land network **144** is implemented as an Internet protocol (IP) network. In other embodiments, land network **144** is implemented as a wired network, an optical network, a fiber network, other wireless networks, or any combination thereof. Land network **144** is connected to one or more landline telephones. Communication network **142** and land network **144** connect wireless carrier system **140** to web-hosting portal **160** and call center **170**.

Client, personal or user computer **150** includes a computer usable medium to execute Internet browser and Internet-access computer programs for sending and receiving data over land network **144** and optionally, wired or wireless communication networks **142** to web-hosting portal **160**. Personal or client computer **150** sends user preferences to web-hosting portal through a web-page interface using communication standards such as hypertext transport protocol (HTTP), and transport-control protocol and Internet protocol (TCP/IP). In one embodiment, the data includes directives to change certain programming and operational modes of electronic and mechanical systems within MVCU **110**. In operation, a client utilizes computer **150** to initiate setting or re-setting of user-preferences for MVCU **110**. User-preference data from client-side software is transmitted to server-side software of web-hosting portal **160**. User-preference data is stored at web-hosting portal **160**.

Web-hosting portal **160** includes one or more data modems **162**, one or more web servers **164**, one or more databases **166**, and a network system **168**. Web-hosting portal **160** is connected directly by wire to call center **170**, or connected by phone lines to land network **144**, which is connected to call center **170**. In an example, web-hosting portal **160** is connected to call center **170** utilizing an IP network. In this example, both components, web-hosting portal **160** and call center **170**, are connected to land network **144** utilizing the IP network. In another example, web-hosting portal **160** is connected to land network **144** by one or more data modems **162**. Land network **144** sends digital data to and from modem **162**, data that is then transferred to web server **164**. Modem **162** may reside inside web server **164**. Land network **144** transmits data communications between web-hosting portal **160** and call center **170**.

Web server **164** receives user-preference data from user computer **150** via land network **144**. In alternative embodiments, computer **150** includes a wireless modem to send data to web-hosting portal **160** through a wireless communication network **142** and a land network **144**. Data is received by land network **144** and sent to one or more web servers **164**. In one embodiment, web server **164** is implemented as any suitable hardware and software capable of providing web services to help change and transmit personal preference settings from a client at computer **150** to telematics unit **120** in MVCU **110**. Web server **164** sends to or receives from one or more databases **166** data transmissions via network system **168**. Web server **164** includes computer applications and files for managing and storing personalization settings supplied by the client, such as door lock/unlock behavior, radio station preset selections, climate controls, custom button configurations and theft alarm settings. For each client, the web server potentially stores hundreds of preferences for wireless vehicle communication, networking, maintenance and diagnostic services for a mobile vehicle.

In one embodiment, one or more web servers **164** are networked via network system **168** to distribute user-preference data among its network components such as database **166**. In an example, database **166** is a part of or a separate computer from web server **164**. Web server **164** sends data transmissions with user preferences to call center **170** through land network **144**.

Call center **170** is a location where many calls are received and serviced at the same time, or where many calls are sent at the same time. In one embodiment, the call center is a telematics call center, facilitating communications to and from telematics unit **120** in MVCU **110**. In an example, the call center is a voice call center, providing verbal communications between an advisor in the call center and a subscriber in a mobile vehicle. In another example, the call center contains each of these functions. In other embodiments, call center **170** and web-hosting portal **160** are located in the same or different facilities.

Call center **170** contains one or more voice and data switches **172**, one or more communication services managers **174**, one or more communication services databases **176**, one or more communication services advisors **178**, and one or more network systems **180**.

Switch **172** of call center **170** connects to land network **144**. Switch **172** transmits voice or data transmissions from call center **170**, and receives voice or data transmissions from telematics unit **120** in MVCU **110** through wireless carrier system **140**, communication network **142**, and land network **144**. Switch **172** receives data transmissions from and sends data transmissions to one or more web-hosting portals **160**. Switch **172** receives data transmissions from or sends data transmissions to one or more communication services managers **174** via one or more network systems **180**.

Communication services manager **174** is any suitable hardware and software capable of providing requested communication services to telematics unit **120** in MVCU **110**. Communication services manager **174** sends to or receives from one or more communication services databases **176** data transmissions via network system **180**. Communication services manager **174** sends to or receives from one or more communication services advisors **178** data transmissions via network system **180**. Communication services database **176** sends to or receives from communication services advisor **178** data transmissions via network system **180**. Communication services advisor **178** receives from or sends to switch **172** voice or data transmissions.

Communication services manager **174** provides one or more of a variety of services, including enrollment services, navigation assistance, directory assistance, roadside assistance, business or residential assistance, information services assistance, emergency assistance, and communications assistance. Communication services manager **174** receives service-preference requests for a variety of services from the client via computer **150**, web-hosting portal **160**,

and land network **144**. Communication services manager **174** transmits user-preference and other data to telematics unit **120** in MVCU **110** through wireless carrier system **140**, communication network **142**, land network **144**, voice and data switch **172**, and network system **180**. Communication services manager **174** stores or retrieves data and information from communication services database **176**. Communication services manager **174** may provide requested information to communication services advisor **178**.

In one embodiment, communication services advisor **178** is implemented as a real advisor. In an example, a real advisor is a human being in verbal communication with a user or subscriber (e.g. a client) in MVCU **110** via telematics unit **120**. In another embodiment, communication services advisor **178** is implemented as a virtual advisor. In an example, a virtual advisor is implemented as a synthesized voice interface responding to requests from telematics unit **120** in MVCU **110**.

Communication services advisor **178** provides services to telematics unit **120** in MVCU **110**. Services provided by communication services advisor **178** include enrollment services, navigation assistance, real-time traffic advisories, directory assistance, roadside assistance, business or residential assistance, information services assistance, emergency assistance, and communications assistance. Communication services advisor **178** communicate with telematics unit **120** in MVCU **110** through wireless carrier system **140**, communication network **142**, and land network **144** using voice transmissions, or through communication services manager **174** and switch **172** using data transmissions. Switch **172** selects between voice transmissions and data transmissions.

FIG. 2 is a block diagram of a telematics based system in accordance with an embodiment of the present invention. **FIG. 2** shows a telematics based system **200** for implementing interactive radio features within a telematics equipped mobile vehicle. In **FIG. 2**, the telematics system includes a mobile vehicle **210** having a telematics unit **220** coupled to one or more vehicle system modules **290** via a vehicle communication bus **212**, and a communication network **270**, such as, for example a wireless carrier system (FIG. 1, 140), and a communication network (FIG. 1, 142) in communication with a public switched telephone network (PSTN). Telematics unit **220** further includes a database **228** that contains programs **231**, stored data **232**, updated data **233** and triggers **234** Vehicle system module (VSM) **290** further includes a program **291** and stored data **292**. Telematics based programming gateway system **200** may include additional components not relevant to the present discussion.

Vehicle system module **290** is any vehicle system control module having software and hardware components for operating, controlling or monitoring one or more vehicle systems. In one embodiment, vehicle system module **290** is a radio receiver, such as, for example a radio receiver capable of receiving radio transmissions including frequency modulated (FM) signals that incorporate an FM sub-carrier signal as is known in the art. In another embodiment, vehicle system module **290** is a controller for controlling a vehicle system such as, for example, a power train control module (PCM). Additional examples of vehicle system modules **290** include diagnostic modules, brake system modules, fluid level modules, fuel consumption monitoring modules, pollution control modules, stability control modules, climate control modules, and the like.

Vehicle system module **290** contains one or more processors, one or more memory devices and one or more connection ports. In one embodiment, VSM **290** includes a software switch for scanning received information to identify that data has been received. VSM **290** is coupled to a vehicle communication bridge **212**, and therefore to any other device that is also coupled to vehicle communication bus **212**. The vehicle communication bus is also referred to as a vehicle communication network. In one embodiment, VSM **290** is directly coupled to telematics unit **220**, such as, for example vehicle communication bus **212** coupling telematics unit **220** to vehicle system modules **290**. In an example, vehicle communication bus **212** is a vehicle communication network **112** as described in **FIG. 1**, above. In another embodiment, VSM **290** is indirectly coupled to telematics unit **220**.

VSM **290** includes one or more programs **291** and stored data **292** stored in memory. In one embodiment, program **291** includes software for receiving radio station information and storing the received radio station information at stored data **292**. In another embodiment, program **291** includes software for receiving radio station information, storing a portion of the received radio station information at stored data **292**, and passing a portion of the received radio station information to telematics unit **220** via communication bus **212**.

Examples of radio station information include radio station identification, radio station telephone number, and one or more radio station messages. Other examples include weather, sports scores, stock quotes and alert information including traffic hotline reports, government emergency alerts, and weather alerts. In an example, program **291** receives the radio station information and stores all of the received radio station information at stored data **292**. In another example, program **291** receives the radio station information, stores the radio station identification and one or more radio station messages for display (detailed in **FIG. 3** below) at stored data **292**, and passes the radio station telephone number to telematics unit **220** via communication bus **212**.

Telematics unit **220** is any telematics device enabled for operation with a telematics service provider, such as, for example telematics unit **120** as described with reference to **FIG. 1**. Telematics unit **220** in vehicle **210** is in communication with communication network **270**. Telematics unit **220** includes volatile and non-volatile memory components for storing data and programs. In one embodiment, memory components in telematics unit **220** contain database **228**.

Database **228** includes one or more programs **231** for operating telematics unit **220**, such as, for example, for implementing interactive radio features within a telematics equipped mobile vehicle. A program module receives radio station information from VSM **290** at updated data **233**. In an example, the radio station information is cached within updated data **233**. The radio station information is stored at stored data **232**. In one embodiment, telematics unit **220** acts as a data cache for radio station information, caching any received radio station information that is provided to vehicle system module **290** for the telematics unit **220**.

In operation, VSM **290**, such as, for example a radio receiver including an interactive interface (detailed in **FIG. 3** below) receives radio station information. In one embodiment, the radio station information is broadcast on a frequency modulated (FM) sub-carrier band. VSM **290** detects whether an initiation command has been received from the user interface portion. In one embodiment, the user interface is a voice activated user interface. In another embodiment, the user interface is manually operable push button user interface.

When the initiation command has been received, VSM **290** provides the radio station information, such as, for example a radio station telephone number to telematics unit **220** responsive to the detected initiation command. Telematics unit **220** acts accordingly based on the provided radio station information and discussed in **FIG. 3**, below.

In one embodiment, VSM **290** receives a communications command and passes the communications command to telematics unit **220**. Telematics unit **220** initiates a wireless communication with communication network **270** (e.g. a "PSTN") responsive to the received communication command.

FIG. 3 is a block diagram of a system for implementing interactive radio features within a telematics equipped mobile vehicle. In **FIG. 3**, the interactive radio system **300** includes a telematics unit **320** coupled to interactive radio module **390** via a vehicle communication bus **312**, one or more wireless carrier systems **340**, one or more communication networks **342**, one or more client centers **350**, and one or more transmitter systems **360**. Interactive radio module **390** further includes a visual user interface **393** portion and a physical user interface **395** portion. Interactive radio system **300** may include additional components not relevant to the present discussion.

Telematics unit **320** is any telematics device enabled for operation with a telematics service provider, such as, for example telematics unit **120** as described with reference to **FIG. 1** and telematics unit **220** as described with reference to **FIG. 2**. Communication network **342** (e.g. a "PSTN") connects wireless carrier system **340** to client center **350** (e.g. a radio station). Communication network **342** is implemented as any suitable system or collection of systems, such as, for example communication network **342** as described with reference to **FIG. 1**.

Transmitter system **360** is any transmitter system enabled for transmitting a modulated signal, such as, for example a frequency modulated (FM) or an amplitude modulated (AM) signal including a sub-carrier band, such as, for example a frequency modulated (FM) sub-carrier band. Transmitter system **360** provides a modulated signal from client center **350** that is received by interactive radio module **390**, such as, for example an interactive radio receiver. In one embodiment, interactive radio module **390** is implemented as VSM **290** as described with reference to **FIG. 2**.

Interactive radio module **390** is any interactive radio receiver that includes visual user interface **393** and physical user interface **395**. Visual user interface **393** is any visual user interface, such as, for example a visual display. Physical user interface **395** is any physical user interface, such as, for example a manually operable push button user interface. Visual displays and physical user interfaces within a radio receiver are known in the art.

Interactive radio module **390** is capable of receiving radio station information, such as, for example from client center **350** via transmitter system **360**. Examples of radio station information include radio station identification, radio station telephone number, and one or more radio station messages. Other examples include weather, sports scores, stock quotes and alert information including traffic hotline reports, government emergency alerts, and weather alerts. In one embodiment, interactive radio module **390** stores the received radio station information and displays radio station identification via visual user interface **393**. In another embodiment, interactive radio module **390** receives the radio station information, stores the radio station identification and one or more radio station messages for display, and passes the radio station telephone number to telematics unit **320** via communication bus **312**.

Interactive radio module **390** receives commands from physical user interface **395**. Examples of commands interactive radio module **390** receives from physical user interface **395** include an initiation command and a communication command. In one embodiment, interactive radio module **390** receives an initiation command from physical user interface **395**. In this embodiment, the initiation command is an indication that a user wants to have one or more radio station messages displayed as well as initiating programming associated with the one or more displayed radio station messages. Examples of radio station messages include radio station contests, alert data such as traffic hotline reports, and government emergency alerts. When interactive radio module **390** receives an initiation command from physical user interface **395**, the

radio station messages are displayed to a user via visual user interface **393** and passes the radio station telephone number to telematics unit **320** via communication bus **312**.

In another embodiment, after interactive radio module **390** receives the initiation command from physical user interface **395**, interactive radio module **390** further receives a communication command from physical user interface **395**. In this embodiment, the communication command is an indication that a user wants to communicate with client center **350** in response to the one or more displayed radio station messages, such as, for example to respond to a radio station contest message displayed via visual user interface **393**.

In yet another embodiment, physical user interface **395** is implemented as a voice activated user interface. In this embodiment, the voice activated user interface performs interface functions as described and attributed to physical user interface **395**, above.

FIG. 4 is a flow diagram of an embodiment of a method of implementing interactive radio features within a telematics equipped mobile vehicle. In **FIG. 4**, method **400** may utilize one or more systems detailed in **FIGS. 1 - 3**, above. The present invention can also take the form of a computer usable medium including a program for configuring an electronic module within a vehicle. The program stored in the computer usable medium includes computer program code for executing the method steps described in **FIG. 4**. In **FIG. 4**, method **400** begins at step **410**.

At step **420**, radio station information is received at an interactive radio module. Examples of radio station information include radio station identification, radio station telephone number, and one or more radio station messages. Other examples include weather, sports scores, stock quotes and alert information including traffic hotline reports, government emergency alerts, and weather alerts. In one embodiment, receiving radio station information includes receiving the radio station information and storing the received radio station information. In

an example and referring to **FIG. 3** above, interactive radio module **390** receives radio station information from client center **350** (e.g. a radio station) via transmitter system **360**. In this example and referring to **FIG. 2** above, VSM **290** (e.g. a radio receiver) receives the radio station information and stores the received radio station information at stored data **292**.

At step **430**, an initiation command received at the interactive radio module from a user interface is detected. In one embodiment, the user interface is a voice activated user interface. In another embodiment, the user interface is manually operable push button user interface. In one embodiment, an interactive radio module receives the initiation command from a physical user interface. In an example and referring to **FIG. 3** above, interactive radio module **390** receives the initiation command from physical user interface **395**.

At step **440**, radio station information is provided to the telematics unit responsive to the detected initiation command. In one embodiment, an interactive radio module provides radio station information to a telematics unit. In an example and referring to **FIG. 3** above, interactive radio module **390** provides radio station information, such as, for example a radio station telephone number to telematics unit **320**.

At optional step **450**, a communication command is received at an interactive radio module from the user interface and a wireless communication (e.g. a voice telephone call) via the telematics unit is initiated responsive to the received communication command. In one embodiment, the interactive radio module receives the communication command from the physical user interface responsive to information displayed on a visual user interface and passes the communication command to the telematics unit to initiate the wireless communication between the telematics unit and a client center.

In an example and referring to **FIG. 3** above, the interactive radio module **390** receives the communication command from the physical user interface **395** responsive to information displayed on a visual user interface **393** and passes the communication command to the telematics unit **320** to initiate the wireless communication between the telematics unit **320** and a client center **350**. In this example, a radio station may include radio station contest information within the radio station information as one or more radio station messages. The contest information is displayed on the visual user interface prompting a user to "call in". The user may then activate a "call in" procedure by accessing the physical user interface.

In another embodiment, optional step **450** is modified so as to remove the portion of reception of the communication command. In this embodiment, upon reception of information displayed on the visual interface, an instruction is passed to the telematics unit to initiate the wireless communication (e.g. a voice telephone call) between the telematics unit and the client center.

At optional step **460**, wireless communication is reinitiated when wireless communication fails. In one embodiment, wireless communication is reinitiated by determining if the initiated wireless communication is connected, initiating wireless voice communication from a user interface (e.g. the telematics unit) when the initiated wireless communication is connected, terminating the wireless communication when the initiated wireless communication is not connected, and reinitializing the terminated wireless communication via the telematics unit responsive to the received communication command. In this embodiment, the wireless communication is reinitiated until the initiated wireless communication is connected. In an example, the wireless communication is (e.g. a voice telephone call) reinitiated when wireless communication fails with a redial feature as is known in the art.

At step **470**, the method ends.

The above-described methods and implementation for implementing interactive radio features within a telematics equipped mobile vehicle are example methods and implementations. These methods and implementations illustrate one possible approach for implementing interactive radio features within a telematics equipped mobile vehicle. The actual implementation may vary from the method discussed. Moreover, various other improvements and modifications to this invention may occur to those skilled in the art, and those improvements and modifications will fall within the scope of this invention as set forth in the claims below.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive.